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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/840,095

05/06/2004

Chao-Lung Chen

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05/03/2006

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EXAMINER

NGUYEN, THANH T

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 05/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/840,095

Applicant(s)

CHEN ET AL.

Examiner

Thanh T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. ____   |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>5/6/04</u> .  | 6) <input type="checkbox"/> Other: ____                                     |

## **DETAILED ACTION**

### ***Information Disclosure Statement***

The information disclosure statement filed on 5/6/04 has been considered.

### ***Oath/Declaration***

Oath/Declaration filed on 5/6/04 has been considered.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 6, 12-13 are rejected under 35 U.S.C. 102(b) as being anticipated by Matsuda et al. (U.S. Patent Publication No. 2002/0000379).

Referring to figures 4-7e, or 8a-9b, Matsuda et al. teaches 1. A method of depositing a metal layer on a wafer, the method comprising:

immersing the wafer (101, 204) in an electrolytic solution containing metal ions (see figures 9b); and

biasing the wafer negatively with respect to the electrolytic solution so as to create a current flow between the electrolytic solution and the wafer and thereby electroplate a metal layer (see paragraph#39 or 65-71) on a surface of the wafer (204) by first biasing the wafer to produce a first current density, then secondly biasing the wafer to produce a second current density, the second current density being greater than zero and less than the first current density (see figures 7e)

regarding to claim 2. wherein the biasing the wafer further includes, after the secondly biasing, thirdly biasing the wafer to produce a third current density, the third current density being greater than the second current density (see figure 7e, the first current is 20, the second current is 1, the third current is 20).

regarding to claim 6. wherein the first biasing, the secondly biasing, and the thirdly biasing are carried out in-situ. It is inherent that since there is no mention of transferring from one chamber to another, hence first, second and third bias are carried in-situ.

regarding to claim 12. wherein the metal ions are copper ions and the metal layer comprises copper (see paragraph# 3).

regarding to claim 13. wherein the surface includes an upper portion and an opening extending downwardly therefrom and the biasing the wafer negatively produces the metal layer substantially completely filling the opening copper (see paragraph# 3).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh et al. (U.S. Patent Publication No. 2005/0095854) in view of Matsuda et al. (U.S. Patent Publication No. 2002/0000379).

Referring to figures 7-11, Uzoh et al. teaches 1. A method of depositing a metal layer on a wafer, the method comprising:

Depositing a seed layer (see paragraph# 39) on a surface of the wafer in the opening (see figures 9-12) ;

Electroplating the metal layer (copper, see paragraph# 39) on the wafer by:

immersing the wafer (see paragraph# 41-53) in an electrolytic solution containing metal ions (see figures 9b); and

biasing the wafer with respect to the electrolytic solution so as to create a current flow between the electrolytic solution and the wafer and thereby electroplate a metal layer (see paragraph# 41-53) on a surface of the wafer by first biasing the wafer to produce a first current density, then secondly biasing the wafer to produce a second current density, the second current density being greater than zero and less than the first current density, the third current density

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between the substrate and the electrolytic solution being greater than the first density, and the fourth current is greater than the third current density (see figures 13-16, paragraphs# 52-56).

However, the reference does not teach wafer negatively bias with the first electrolytic solution, and the specific current density, bias time, deposition rate, the width of the via, the concentration and the flow rate of the electrolytic solution.

Matsuda et al. teaches the wafer negatively bias with the electrolytic solution (cathode (-) see figures 8a-9b).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would recognize that wafer to be negatively biased so that positively charge comprise metal ions would deposit on the wafer in the process of Uzoh et al.

It would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to optimize the current density, bias time, deposition rate, the width of the via, the concentration and the flow rate of the electrolytic solution, since it has been held that where the general conditions of a claim are disclosed in the prior art (i.e.- current density, bias time, deposition rate, the width of the via, the concentration and the flow rate of the electrolytic solution), discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233 (CCPA 1955).

The specification contains no disclosure of either the critical nature of the claimed arrangement (i.e.- the specific current density, bias time, deposition rate, the width of the via, the concentration and the flow rate of the electrolytic solution) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon

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another variable recited in a claim, the applicant must show that the chosen limitations are critical. In re Woodruff, 919 F.2d 1575, 1578 (FED. Cir. 1990).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would electroplating the metal layer by using the specific current density, bias time, deposition rate, the width of the via, the concentration and the flow rate of the electrolytic solution in the process of Uzoh et al. because it is known to choose the optimum range to form a layer involves routine skill in the art.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).



Thanh Nguyen  
Patent Examiner  
Patent Examining Group 2800

TTN